

REMARKS

As an initial matter, applicant thanks the Examiner for the courtesies extended to undersigned in the telephone interview concluded on December 19, 2007.

The application has been reviewed in light of the final Office Action dated June 26, 2007 and the Advisory Action dated October 1, 2007. Claims 1-13 are pending. By this Amendment, claims 1 has been amended to further clarify the claimed subject matter. Accordingly, claims 1-13 are presented for continued examination, with claim 1 being in independent form.

Claims 1-13 were rejected under 35 U.S.C. § 102(b) as purportedly anticipated by U.S. Patent No. 6,307,368 to Vasanaawala et al.

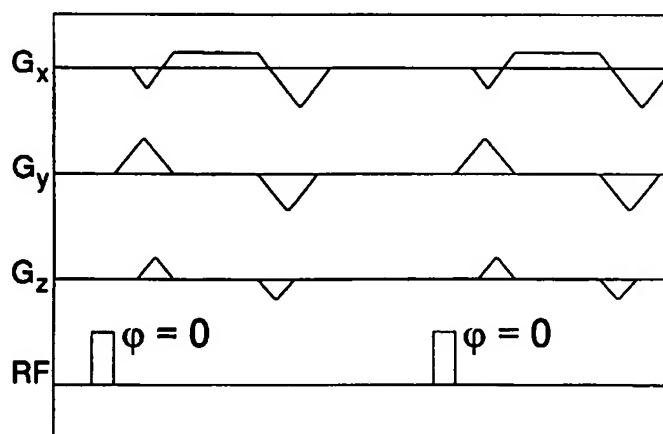
Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claim 1 of the present application is patentable over the cited art, as discussed in the telephone interview, including the reasons reiterated below.

This application relates to improvements devised by applicant for a magnetic resonance imaging (MRI) apparatus which enables the excitation to be selectively applied to a local region. In an aspect of this application, the MRI apparatus includes RF transmitting means including a first coil and one or more additional coils, for applying an RF excitation pulse, and RF irradiation control means which controls RF irradiation so that the RF excitation pulse is simultaneously applied to each of the first coil and the one or more additional coils such that a phase of a second half of a waveform of an output of at least one of the one or more additional coils, after the temporal center of the RF excitation pulse, is different by 180° from a phase of the first half of the waveform. Independent claim 1 addresses such features, as well as other features.

Vasanaawala, as understood by Applicant, proposes a spectrally-selective, steady-state free precession (SSFP) technique in MR imaging wherein selected sequences of RF excitation

pulses are applied to produce an equilibrium magnetization that fluctuates between several values. In the approach of Vasanaawala, the phases of RF pulses can be controlled so that the phases of the pulse sequence are cyclically changed. For example, in imaging with sequences of excitation pulses, the phases of successive RF pulses in a sequence of a first type are set to be  $0^\circ$ - $0^\circ$ - $0^\circ$ , respectively, and the phases of a sequence of successive RF pulses of a second type are set to be  $0^\circ$ - $90^\circ$ - $180^\circ$ - $270^\circ$  and thus the phase is changed cyclically in this order in the second type of sequence. Further, in third and fourth types of sequences, the phases of RF pulses are set to be  $0^\circ$ - $180^\circ$ - $0^\circ$ - $180^\circ$ , and  $0^\circ$ - $270^\circ$ - $180^\circ$ - $90^\circ$  and the phase is changed cyclically. None of the phase change types proposed by Vasanaawala involves phase change in a single RF pulse. Instead, in each instance of phase change in Vasanaawala, the phase change is between one RF pulse and another RF pulse in a series of plural pulses.

Fig. 3 of Vasanaawala (reproduced below), which was cited in the Office Action, is a timing diagram for a standard SSFP sequences:



**FIG. 3**

Vasanaawala, column 4, lines 51-60, states as follows:

A standard SSFP sequence is depicted in FIG. 3, which is a *timing diagram for two phase encoding steps of a 3D free precession sequence*. Note that magnetization is completely rewound over a repetition time, TR. Although *the two RF phases are zero in the diagram, a linearly increasing phase from excitation to excitation also constituted an SSFP sequence. After every RF excitation, phase encode gradient and data acquisition, spins are completely rephased* with refocusing gradients on all three axes.

Thus, the waveform RF in Fig. 3 of Vasanaawala shows *two RF excitation pulses (RF), with each pulse having a phase of zero*. As pointed out in Vasanaawala, in each sequence of RF pulses, the phase can be varied between one pulse and the next pulse.

None of the RF excitation pulses (RF) in Fig. 3 of Vasanaawala have varying phases in which a phase of a second half (that is, after the temporal center) of the RF pulse is different by  $180^\circ$  from a phase of the first half of the same RF pulse.

As discussed in the telephone interview, waveforms  $G_x$ ,  $G_y$  and  $G_z$  in Fig. 3 of Vasanaawala represent gradient magnetic field waveforms, and not excitation pulses.

The graphs illustrated in Figs. 4A and 4B of Vasanaawala show the responses to the excitations and do not show the RF excitation waveform.

Figs. 4A and 4B of Vasanaawala, contrary to the contention in the Office Action, does not illustrate the phases of the 1<sup>st</sup> and 2<sup>nd</sup> halves of the RF excitation waveform.

The cited art simply does not teach or suggest a magnetic resonance imaging apparatus wherein a RF transmitting means includes a first coil and one or more additional coils, for applying an RF excitation pulse, and a RF irradiation control means controls RF irradiation so that a RF excitation pulse is applied with a phase of the second half of the RF pulse waveform after the temporal center of the RF pulse being different by  $180^\circ$  from the phase of the first half of the RF pulse waveform, as provided by the subject matter of claim 1 of the present

application.

The subject matter of claim 1 of the present application is directed to spatially-selective imaging, where excitation is selectively excited to a local region (and thus artefacts outside of the local region can be avoided in the image). Such technique is quite different in objectives, means and effects from the LCSSFP approach of Vasanawala.

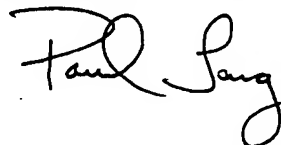
Accordingly, for at least the above-stated reasons, Applicant respectfully submits that independent claim 1 and the claims depending therefrom are patentable over the cited art.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Paul Teng", written in a cursive style.

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